hybridize. In this connection it is found that tubes penetrate rather deeply into agar. The work with several species of lilies shows that the tubes penetrate most rapidly in stigmas of the same species, and progressively slower as the species becomes more distant. When the tube penetration was slow in these crosses, it became continuously slower as the depth of penetration increased, and finally ceased short of the embryo sac. The writer thinks that he has shown that this behavior is due to shortage of nutrient or stimulative materials and not due to toxic materials. His evidence, however, is not at all against the gradual formation of antibodies, a suggestion made by JOST. Self-sterility and failure to hybridize, so far as it is due to lack of tube penetration, deserves a thorough physiological study in the light of our modern knowledge of antibodies and of several other phases of physiology. The later evidence (perhaps not entirely conclusive) that the character of self-sterility mendelizes does not subtract in the least from the need of such an exhaustive physiological study.—WILLIAM. CROCKER.

A new type of embryo sac.—The evolution of the sporophyte and the gradual reduction of the gametophyte are well known to every botanist. In the angiosperms, where the reduction of the gametophyte generation is most extreme, intensive research has revealed several types of embryo sac. Doubtless the most common type and the one long believed to be practically the only type is the familiar 8-nucleate sac, two of whose nuclei fuse to form the endosperm nucleus. This sac is formed by one of a row of 4 megaspores. Soon the *Lilium* type, looking like the preceding but formed from 4 megaspores, was discovered. Sacs with 16 nuclei, some formed from four megaspores and some from a single megaspore, were added to the list. *Cypripedium* has a 4-nucleate sac formed from two megaspores. Since the discovery of the *Cypripedium* type, other 4-nucleate sacs have been found, some formed from one megaspore and some from two.

A new type of embryo sac has been found in *Plumbagella*, one of the Plumbaginaceae.[7] The development starts as in *Lilium*, there being 4 megaspores, not separated by walls, but there are no further nuclear divisions. One nucleus becomes the nucleus of the egg, two fuse to form an endosperm nucleus, and the remaining nucleus, which is at the antipodal end of the sac, disintegrates. At the time of fertilization, there are only two nuclei in the sac. The most important feature is that a megaspore functions directly as the egg. The fusion of two megaspore nuclei to form an endosperm nucleus is also new. Without question, this is the most reduced female gametophyte ever described, and in the nature of the case the reduction can go no farther. DAHLGREN recognizes that the reduction is as extreme as in animals, and he compares this sac with the egg and three polar bodies.

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[7] DAHLGREN, K. V. OSSIAN, Der Embryosack von *Plumbagella*, ein neuer Typus. Arkiv für Botanik **14**:1–10. *figs.* 5. 1915.

Ten years ago, in a paper on alternation of generations in animals,[8] the reviewer predicted that gametophytes more reduced than those known at that time might still be found. Miss PACE soon described the *Cypripedium* type and afterward various investigators found digressions from the "normal" type in *Peperomia*, *Penaea*, *Oenothera*, *Clintonia*, *Lawia*, *Podostemon*, *Dicraea*, *Helosis*, and *Plumbagella*.

It is interesting to note that the most reduced sac has not been found in the most advanced family. It has been a prevalent custom for investigators to focus their attention upon forms which at the moment seemed to have particular phylogenetic significance, forgetting not only that phylogenetic schemes might be awry, but also that facts of great importance in interpreting phylogeny might be found in plants not in the supposed line of ascent.—C. J. CHAMBERLAIN.

Phytopathology in the tropics.—Dr. JOHANNA WESTERDIJK presented a paper at the twenty-fifth anniversary celebration of the Missouri Botanical Garden[9] dealing with the general facts concerning plant diseases in the tropics, based upon recent observations she had made in the Dutch colonies of the East Indies. The combination of high temperature and moisture would seem to be peculiarly favorable to fungi, and therefore to diseases of economic plants induced by fungi; but in fact there are only a few such diseases of real importance. Not only among cultivated plants, but also among the native plants are attacks of fungi rare. Dr. WESTERDIJK has concluded that the tropical temperature is too high for many fungi, a conclusion confirmed also by experimental work. The condition of the tropical host is also unfavorable for invasion by fungi because of the high water content and small air content of the tissues concerned. Among the disease-producing fungi in the tropics, mention is made of the root fungi (certain Hymenomycetes) which attack practically all cultural woody plants. The fungi (certain Ascomycetes and Fungi Imperfecti) inducing die-back diseases of orchards and forests, so common in temperate regions, are represented in the tropics only by a *Corticium* (a Hymenomycete); and there are no representatives of the powdery mildews (Erysiphaceae). The relation of fungus attacks to temperature is well shown in the behavior of *Phytophthora infestans* in Java, where potatoes are cultivated in mountain districts between 1500 and 6000 feet altitude. In the lower areas the infected regions are rare, but in ascending to the higher areas of lower temperature, the more destructive does *Phytophthora* become. Among the rusts there is only one representative of importance in tropical agriculture, namely the coffee leaf disease (*Hemileia vastatrix*). Leaf spot diseases are much less frequent than in Europe or in the United States; while bacterial

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[8] BOT. GAZ. **39**:137–144. 1905.

[9] WESTERDIJK, JOHANNA, Phytopathology in the tropics. Annals Mo. Bot. Gard. **2**:307–313. 1915.